

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
 United States Patent and Trademark
 Office
 Box PCT
 Washington, D.C.20231
 ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 18 May 2000 (18.05.00)	
International application No. PCT/EP99/07067	Applicant's or agent's file reference 8J21PC
International filing date (day/month/year) 23 September 1999 (23.09.99)	Priority date (day/month/year) 25 September 1998 (25.09.98)
Applicant GARCIA-MARTIN, Miguel-Angel et al	

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

10 April 2000 (10.04.00)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer F. Baechler Telephone No.: (41-22) 338.83.38
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 8J21PC	FOR FURTHER ACTION		See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/EP99/07067	International filing date (day/month/year) 23/09/1999	Priority date (day/month/year) 25/09/1998	
International Patent Classification (IPC) or national classification and IPC H04Q3/00			
Applicant TELEFONAKTIEBOLAGET L M ERICSSON (publ) et al.			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p><input type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input checked="" type="checkbox"/> Certain defects in the international application VIII <input type="checkbox"/> Certain observations on the international application 			
Date of submission of the demand 10/04/2000		Date of completion of this report 26.06.2000	
Name and mailing address of the international preliminary examining authority: <div style="display: flex; align-items: center;"> <div> European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465 </div> </div>		Authorized officer Kreppel, J Telephone No. +49 89 2399 8246	



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP99/07067

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-13 as originally filed

Claims, No.:

1-8 as originally filed

Drawings, sheets:

1/2-2/2 as originally filed

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
☐ the claims, Nos.:
☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP99/07067

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-8
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-8
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-8
	No:	Claims	

2. Citations and explanations

see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

With respect to item V

1 Prior art and its problems

The invention relates to a method of transmitting signaling information in a telecommunications network (claim 1), an apparatus for transmitting signaling information in a telecommunications network (claim 7) and a gateway node for coupling signaling information from a common channel signalling network of a telecommunications system to an Internet Protocol based network (claim 8).

The installation and maintenance of a conventional SS7 network is in general expensive due to the effort for creation and update of routing tables necessary to route the signaling messages through the network.

2 Object

It is therefore an object of the present invention to provide a method of transmitting signaling messages and corresponding apparatus which reduces the effort to install and maintain the signaling network.

3 Solution and advantages

This is achieved by applying Internet technology for the transmission of signaling messages. The high layer signaling protocols, i.e. the Application Parts like the Mobile Application Part (MAP) or the Intelligent Network Application Part (INAP), the Transaction Capabilities Application Part (TCAP) and the Signaling Connection and Control Part (SCCP) are coupled via an adaption layer to an IP based protocol stack including TCP or UDP, IP and the subnetwork dependent layers. An SCCP based gateway provides a transit point between a conventional MTP based and an IP-based signaling transport network.

The use of the IP based network for transmitting signaling information reduces the need for conventional signaling infrastructure. IP based networks offer increased flexibility, e.g. via self adapting routing tables, and thus reduces operating, maintaining and engineering costs in comparison with a conventional SS7

network. The gateway allows the usage of IP based and MTP based signaling transport in parallel.

4 Conclusions of the preliminary examination report

No direct transmission of SS7 high layer protocols via an IP based network is known from the prior art. Document D1 = SEVCIK M ET AL: 'CUSTOMERS IN DRIVER'S SEAT: PRIVATE INTELLIGENT NETWORK CONTROL POINT' PROCEEDINGS OF THE INTERNATIONAL SWITCHING SYMPOSIUM, DE, BERLIN, VDE VERLAG, vol. SYMP. 15, page 41-44 XP000495622 ISBN: 3-8007-2093-0 which is considered as representing the closest prior art to the subject-matter of the present invention discloses the rough idea of a conversion of signaling transport from SS7 to TCP/IP but does not disclose any details of the solution and does therefore not disclose or render obvious the subject-matter of the independent claims.

The subject-matter of independent **claims 1, 7 and 8** therefore meets the requirements of Article 33 (2)-(4) PCT regarding novelty, inventive step and industrial applicability. **Claims 2 to 6** are dependent on claim 1 and therefore also novel, inventive and industrially applicable.

With respect to item VII:

- 1 The claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
- 2 Claim 8 contains an obvious error: "Destination Port Code" should read "Destination *Point* Code" (cp. the description page 6, line 30)

The demand must be filed directly with the competent International Preliminary Examining Authority or, if two or more Authorities are competent, with the one chosen by the applicant. The full name or two-letter code of that Authority may be indicated by the applicant on the line below:

IPEA/ EP

PCT

CHAPTER II

DEMAND

under Article 31 of the Patent Cooperation Treaty:

The undersigned requests that the international application specified below be the subject of international preliminary examination according to the Patent Cooperation Treaty and hereby elects all eligible States (except where otherwise indicated).

For International Preliminary Examining Authority use only

Identification of IPEA		Date of receipt of DEMAND
Box No. I IDENTIFICATION OF THE INTERNATIONAL APPLICATION		Applicant's or agent's file reference 8J21PC
International application No. PCT/EP99/07067	International filing date (day/month/year) 23 September 1999 (23.09.99)	(Earliest) Priority date (day/month/year) 25 September 1998 (25.09.98)
Title of invention SIGNALLING IN A TELECOMMUNICATIONS SYSTEM		
Box No. II APPLICANT(S)		
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) TELEFONAKTIEBOLAGET LM ERICSSON (publ) S-126 25 Stockholm Sweden		Telephone No.: Facsimile No.: Teleprinter No.:
State (that is, country) of nationality: SE	State (that is, country) of residence: SE	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) GARCIA-MARTIN, Miguel-Angel Pase Esperanza 8 esc. 3, 7-B E-28005 Madrid Spain		
State (that is, country) of nationality: ES	State (that is, country) of residence: ES	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.) GARCIA GONZALES, Juan, Maria Banos de Montemayor 6, 1 B E-28005 Madrid Spain		
State (that is, country) of nationality: ES	State (that is, country) of residence: ES	
<input type="checkbox"/> Further applicants are indicated on a continuation sheet.		

Box No. III AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCEThe following person is ☒ agent ☐ common representativeand ☒ has been appointed earlier and represents the applicant(s) also for international preliminary examination.☐ is hereby appointed and any earlier appointment of (an) agent(s)/common representative is hereby revoked.☐ is hereby appointed, specifically for the procedure before the International Preliminary Examining Authority, in addition to the agent(s)/common representative appointed earlier.Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*BORENIUS & CO OY AB
Kansakoulukuja 3
FIN-00100 Helsinki
Finland

Telephone No.:

+358-9-6866840

Facsimile No.:

+358-9-68668444

Teleprinter No.:

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.**Box No. IV BASIS FOR INTERNATIONAL PRELIMINARY EXAMINATION****Statement concerning amendments:***

1. The applicant wishes the international preliminary examination to start on the basis of:

☒ the international application as originally filedthe description ☒ as originally filed
☐ as amended under Article 34the claims ☒ as originally filed
☐ as amended under Article 19 (together with any accompanying statement)
☐ as amended under Article 34the drawings ☒ as originally filed
☐ as amended under Article 342. ☐ The applicant wishes any amendment to the claims under Article 19 to be considered as reversed.3. ☐ The applicant wishes the start of the international preliminary examination to be postponed until the expiration of 20 months from the priority date unless the International Preliminary Examining Authority receives a copy of any amendments made under Article 19 or a notice from the applicant that he does not wish to make such amendments (Rule 69.1(d)). *(This check-box may be marked only where the time limit under Article 19 has not yet expired.)*

* Where no check-box is marked, international preliminary examination will start on the basis of the international application as originally filed or, where a copy of amendments to the claims under Article 19 and/or amendments of the international application under Article 34 are received by the International Preliminary Examining Authority before it has begun to draw up a written opinion or the international preliminary examination report, as so amended.

Language for the purposes of international preliminary examination: English☒ which is the language in which the international application was filed.☐ which is the language of a translation furnished for the purposes of international search.☐ which is the language of publication of the international application.☐ which is the language of the translation (to be) furnished for the purposes of international preliminary examination.**Box No. V ELECTION OF STATES**The applicant hereby elects all eligible States *(that is, all States which have been designated and which are bound by Chapter II of the PCT)*

excluding the following States which the applicant wishes not to elect:

Box No. VI CHECK LIST

The demand is accompanied by the following elements, in the language referred to in Box No. IV, for the purposes of international preliminary examination:

- | | | |
|--|---|--------|
| 1. translation of international application | : | sheets |
| 2. amendments under Article 34 | : | sheets |
| 3. copy (or, where required, translation) of amendments under Article 19 | : | sheets |
| 4. copy (or, where required, translation) of statement under Article 19 | : | sheets |
| 5. letter | : | sheets |
| 6. other (specify) | : | sheets |

For International Preliminary Examining Authority use only

received not received

<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	<input type="checkbox"/>

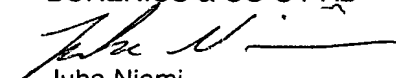
The demand is also accompanied by the item(s) marked below:

- | | |
|--|---|
| 1. <input checked="" type="checkbox"/> fee calculation sheet | 4. <input type="checkbox"/> statement explaining lack of signature |
| 2. <input type="checkbox"/> separate signed power of attorney | 5. <input type="checkbox"/> nucleotide and or amino acid sequence listing in computer readable form |
| 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: | 6. <input type="checkbox"/> other (specify): |

Box No. VII SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the demand).

BORENIUS & CO OY AB


Juha Niemi
patent agent

For International Preliminary Examining Authority use only

1. Date of actual receipt of DEMAND:

2. Adjusted date of receipt of demand due to CORRECTIONS under Rule 60.1(b):

3. ☐ The date of receipt of the demand is AFTER the expiration of 19 months from the priority date and item 4 or 5, below, does not apply.

☐ The applicant has been informed accordingly.

4. ☐ The date of receipt of the demand is WITHIN the period of 19 months from the priority date as extended by virtue of Rule 80.5.

5. ☐ Although the date of receipt of the demand is after the expiration of 19 months from the priority date, the delay in arrival is EXCUSED pursuant to Rule 82.

For International Bureau use only

Demand received from IPEA on:

PCT

REC'D 28 JUN 2000

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

WIPO

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(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 8J21PC	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/EP99/07067	International filing date (day/month/year) 23/09/1999	Priority date (day/month/year) 25/09/1998
International Patent Classification (IPC) or national classification and IPC H04Q3/00		
Applicant TELEFONAKTIEBOLAGET L M ERICSSON (publ) et al.		

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- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 10/04/2000	Date of completion of this report 26.06.2000
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Kreppel, J Telephone No. +49 89 2399 8246



**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. PCT/EP99/07067

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EXAMINATION REPORT**

International application No. PCT/EP99/07067

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The subject-matter of independent **claims 1, 7 and 8** therefore meets the requirements of Article 33 (2)-(4) PCT regarding novelty, inventive step and industrial applicability. **Claims 2 to 6** are dependent on claim 1 and therefore also novel, inventive and industrially applicable.

With respect to item VII:

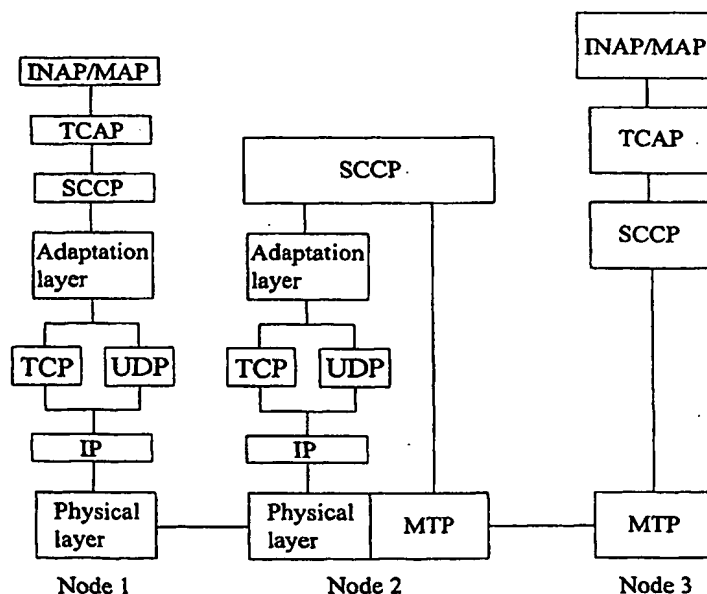
- 1 The claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).
- 2 Claim 8 contains an obvious error: "Destination Port Code" should read "Destination *Point* Code" (cp. the description page 6, line 30)



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁷ : H04Q 3/00		A1	(11) International Publication Number: WO 00/19739
			(43) International Publication Date: 6 April 2000 (06.04.00)
(21) International Application Number: PCT/EP99/07067 (22) International Filing Date: 23 September 1999 (23.09.99) (30) Priority Data: 982074 25 September 1998 (25.09.98) FI (71) Applicant (for all designated States except US): TELEFON- AKTIEBOLAGET LM ERICSSON (publ) [SE/SE]; S-126 25 Stockholm (SE). (72) Inventors; and (75) Inventors/Applicants (for US only): GARCIA-MARTIN, Miguel-Angel [ES/ES]; Pase Esperanza 8, esc. 3, 7-B, E-28005 Madrid (ES). GARCIA GONZALES, Juan, Maria [ES/ES]; Banos de Montemayor 6, 1 B, E-28005 Madrid (ES). (74) Agent: BORENIUS & CO OY AB; Kansakoulukuja 3, FIN-00100 Helsinki (FI).			(81) Designated States: AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), DM, EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the</i> <i>claims and to be republished in the event of the receipt of</i> <i>amendments.</i>

(54) Title: SIGNALLING IN A TELECOMMUNICATIONS SYSTEM



(57) Abstract

A method of transmitting signalling information in a Public Land Mobile Network (PLMN) between a pair of peer application parts. An adaptation layer is interposed between the SCCP of an SS7 network and a TCP/IP part to allow signalling data to be transmitted to and from the SCCP via an IP based network. The adaptation layer provides for translation between Destination Point Codes (DPCs) and or global titles, used as addresses in the SS7 network, and IP addresses/port numbers for use in the IP network. The adaptation layer also provides for formatting of SCCP messages suitable for processing by the TCP/IP layers, and also for formatting signalling information flowing in the reverse direction.

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Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
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DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

Signalling in a Telecommunications System

Field of the Invention

The present invention relates to signalling in a telecommunications system and in particular, though not necessarily, to the transmission of signalling data in a Public Land Mobile Network.

Background to the Invention

In a telecommunications system, signalling equipment and signalling channels are required for the exchange of information between system elements or nodes. In particular, this internode signalling informs the nodes of what is to be performed when a telephone or data call is to be set up or released in so-called "circuit-switched" connections. Signalling is also often used to communicate information on the status of the system and of individual subscribers.

Modern telecommunications systems now largely make use of Common Channel Signalling (CCS) whereby signalling information is transmitted on one or more dedicated signalling channels, distinct from the channels used to carry actual user information (e.g. voice or data). An important feature of CCS is that the same signalling system may support services in a variety of existing telecommunications networks, e.g. Public Switched Telephone Network (PSTN), Integrated Services Digital Network (ISDN), and Public Land Mobile Networks (PLMN), as well as proposed future protocols such as B-ISDN, enhancing greatly the interoperability of networks supporting different protocols.

Currently, the predominant CCS is known as Signalling System Number 7 (SS7), defined in the ITU-T (International Telecommunications Union - Technical) recommendations starting with Q.700. SS7 is a packet switched system occupying one time slot per frame of the Time Division Multiple Access (TDMA) E.1 or T.1 transmission formats (the other time slots being available for user voice or data information). Individual signalling message packets (referred to as Message Signalling Units or MSUs) are associated with respective individual telephone calls. As only a relatively small amount of signalling information is associated with a single telephone call, a single SS7 channel is able to handle all signalling between two network nodes (termed "signalling points") for several thousands of calls. It is noted that the route taken by an MSU in the SS7 network may be the same as that over which the associated telephone call is established, or it may be different.

As already noted, SS7 (along with other CCS systems) is able to support a number of different telecommunications networks (e.g. PSTN, ISDN, PLMN). In signal processing terms, SS7 comprises a Message Transfer Part (MTP) which deals with the physical transfer of signalling information over the signalling network (MTP layer 1), message formatting, error detection and correction, etc (MTP layer 2), and message routing (MTP layer 3). SS7 also comprises user parts and application parts which allow several "users" (i.e. ISDN User Part, Telephony User Part, Mobile Application Part, etc) to send signals in the same signalling network.

Figure 1 illustrates a PLMN (GSM) having a Gateway Mobile Switching Centre (GMSC) 1 which provides an interface for the PLMN to "foreign" networks such as

ISDNs, PSTNs, and other PLMNs. An exemplary Mobile Station (MS), registered to the PLMN, is indicated by the reference numeral 2. A number of exemplary nodes within the PLMN are also shown including: the GMSC 1; a Mobile Switching Centre (MSC) 3; a Base Station Controller (BSC) 4; a Base Transceiver Station (BTS) 5; an Intelligent Network node (IN) 6; a Visitor Location Register (VLR) 7; a Home Location Register (HLR) 8; an Authentication Centre (AUC) 9; and an Equipment Identity Register (EIR) 10. A more complete description of a PLMN, and other aspects of telecommunication networks, is given in "Understanding Telecommunications", vols. 1 & 2, Studentlitteratur, Lund, Sweden (ISBN 91-44-00214-9).

Figure 1 indicates the various signalling interfaces which are used to signal between the network nodes detailed above. These interfaces include: the ISUP/TUP interfaces between the GMSC 1 and the foreign networks; the INAP interface used between the MSC 3 and Intelligent Network (IN) nodes; the MAP interface used between the MSC/GMSC 1,3 and PLMN specific nodes (VLR, HLR, AUC, EIR) 6-10; the BSSMAP used between the MSC 3 and the BSC 4; and the Abis interface between the BSC 4 and the BTS 5. Conventionally, all of these interfaces serve as user parts and application parts of an SS7 network, residing above the MTP layers. The resulting protocol stacks are illustrated in Figure 2.

In order to provide the INAP and MAP (as well as certain other application parts, e.g. OMAP, which also rely upon connectionless communication over the signalling network) with certain functions and protocols as well as a standard and common interface between the application parts and the network signalling service, a Transaction Capabilities Application Part (TCAP or TC) is interposed

between these application parts and the MTP. Furthermore, a Signalling Connection and Control Part (SCCP) is interposed between the TCAP and the MTP for controlling the signalling connection. The SCCP is also used by certain other application parts (referred to as SCCP users, e.g. BSSMAP) which do not use the services of the TCAP and which rely upon connection-oriented and/or connectionless communication over the signalling network.

SS7 makes use of addresses known as Destination Point Codes (DPCs) to route signalling data through the "visibility area" of a telecommunications network, the visibility area typically being the network itself together with the interfaces between the network and "foreign" networks under the control of other operators. A DPC is placed in the header of an MSU and is examined by a network signalling point (SP) upon receipt of the MSU to determine the next hop for the MSU en route to its destination. So-called Subsystem Numbers (SSNs) are used by SS7 to direct data to specific application parts (see below) and are also included in MSUs.

With reference to Figure 2, it is noted that routing between various application parts above the SCCP layer is achieved using so-called "global titles". A global title contains (amongst other things) a number dialled in the PLMN or the number of a roaming mobile station (for the specific example shown in Figure 1). The SCCP contains all the network and routing information required to analyse a global title and translate it into a DPC and, optionally, a Subsystem Number (SSN) which identify the next or final signalling point in the SS7 network.

In an SS7 network, any change in the DPC allocation within the visibility area requires the operator to update the DPC database (or routing table) which exists in each SP of the network. This however adds significantly to the maintenance overheads of the network. The dedicated nature of SS7 makes it in general expensive to install and maintain (in relation to both hardware and software), a significant barrier especially to prospective new telecom operators. Furthermore, as an SS7 network occupies bandwidth on TDMA frames of the E.1/T.1 transmission protocols (one slot per time frame), the bandwidth available for actual user call data is restricted. Yet another disadvantage of traditional signalling architectures is that the interoperability of SS7 networks is limited due to the dedicated nature of the MTP physical layers.

Summary of the Present Invention

It is an object of the present invention to overcome or at least mitigate the above noted disadvantages of existing telecommunication signalling systems.

According to a first aspect of the present invention there is provided a method of transmitting signalling information in a telecommunications network between a pair of application parts, the method comprising;

- generating said signalling information at a first of said application parts, including addressing information associated with the second of the application parts;

- passing the signalling information to a Signalling Connection Control Part (SCCP) arranged to segment the signalling information if necessary, and to encapsulate the information in one or more SCCP messages;

- passing the encapsulated signalling information from the SCCP to an adaptation layer arranged to

determine an IP address and port number associated with said addressing information;

passing the signalling information and said IP address and port number to an Internet Protocol (IP) part and transmitting the signalling information over an IP network to said IP address in one or more IP datagrams;

decapsulating said signalling information at the destination associated with the IP address and at an adaptation layer identified by said port number; and

routing the decapsulated signalling information to the second user part.

The use of the IP based network for transmitting signalling information reduces the need for conventional signalling infrastructure (although this may still be used in part). IP based networks offer increased flexibility (e.g. routers of the network have self-updating routing tables) and reduced operating, maintaining, and engineering costs in comparison with conventional telecommunications signalling networks.

The method of the present invention is particularly applicable to Public Land Mobile Networks (PLMN), where said pair of application parts may be, for example, peer Mobile Application Parts (MAPs) or Intelligent Network Application Parts (INAPs) present at respective signalling nodes of the PLMN.

In certain embodiments of the invention, the SCCP performs a translation between said addressing information (e.g. a global title) and an associated Destination Point Code (DPC) and, optionally, a Subsystem Number (SSN). In this case, the IP address and port number are determined, at the adaptation layer, by way of the DPC, rather than directly from the global title. In other embodiments however, the IP address and

port number are obtained at the adaptation layer directly from a global title.

Preferably, the adaptation layer is arranged to monitor the state of the signalling connection over the IP based network and to report on this to the SCCP.

Preferably, the signalling information is passed from the adaptation layer to the IP part via a UDP or TCP encapsulating layer. More preferably, the adaptation layer is arranged to encapsulate signalling and addressing information into a form suitable for further processing by the UDP or TCP layers.

The signalling information generated at the first application part may be passed to the SCCP via a Transaction Capabilities Application part. Alternatively, the application part may pass information directly to the SCCP. It is noted that a function of the SCCP is to facilitate both connectionless and connection oriented communication over the signalling channel, in addition to its routing and encapsulation functions.

According to a second aspect of the present invention there is provided apparatus for transmitting signalling information in a telecommunications network between a pair of application parts, the apparatus comprising;
generating means for generating said signalling information at a first of said application parts, including addressing information associated with the second of the application parts;

a Signalling Connection Control Part (SCCP) arranged to receive said signalling information and to segment the signalling information if necessary, and to encapsulate the information in one or more SCCP messages;

an adaptation layer arranged to receive the encapsulated signalling information and to determine an IP address and port number associated with said addressing information;

an Internet Protocol (IP) part receiving the signalling information and said IP address and port number and for arranging transmission of the signalling information over an IP network to said destination IP address in one or more IP datagrams;

an adaptation layer at the destination associated with the IP address, and identified by said port number, for decapsulating said signalling information; and

routing means for routing the signalling information to the second user part.

According to a third aspect of the present invention there is provided a gateway node for coupling signalling information from a common channel signalling (CCS) network of a telecommunications system, to an Internet Protocol (IP) based network, the gateway node comprising:

a Message Transfer Part (MTP) arranged to receive signalling information over the CCS network;

a Signalling Connection Control Part (SCCP) arranged to receive said signalling information from the MTP whilst controlling the signalling connection over the CCS network;

an adaptation layer arranged to receive said signalling information from the SCCP in the form of one or more SCCP messages, to determine an IP address and port number associated with a global title or Destination Port Code (DPC) included in the SCCP message(s), and to control the connection over the IP based network;

an IP layer for receiving the signalling information and the IP address and port number from the adaptation layer and for arranging for transmission of

the signalling information over the IP based network in the form of IP datagrams.

Brief Description of the Drawings

For a better understanding of the present invention and in order to show how the same may be carried into effect reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 illustrates schematically a GSM network together with the signalling protocols used therein;

Figure 2 illustrates schematically the signal processing layers of an SS7 protocol of the network of Figure 1;

Figure 3 illustrates schematically the use of a TCP/IP network to transmit signalling information in a telecommunications network; and

Figure 4 illustrates signalling protocol layers present at nodes of the telecommunications network of Figure 3.

Detailed Description of Certain Embodiments

The general structure in terms of signalling nodes and signalling interfaces of a GSM PLMN has already been described above with reference to Figures 1 and 2.

Figure 3 shows various nodes of the GSM PLMN where it is assumed, for the purpose of this discussion, that each of these nodes comprises an application part (e.g. MAP, INAP) having a conventional composition such that it can be supported by SS7 for the sending of signalling information to a peer application part at some other node. Considering in particular the MSCs 3a, 3b and the GMSC 1, these nodes are connected to a conventional SS7 network 11 for the purpose of communicating signalling information.

Intelligent network and mobile network specific nodes, including the IN node 6, VLR 7, HLR 8, AUC 9, and EIR 10, each have application parts (and in particular MAP and INAP) similarly constructed for peer-to-peer communication via SS7. However, these nodes each comprise an additional interface which enables them to communicate signalling information via an IP network 12. In order to enable interworking of the SS7 connected nodes and the IP network connected nodes, the two signalling networks 11,12 are connected by a gateway node 13.

Figure 4 shows schematically the protocol layers present at a node connected to the IP network 12 (Node 1), at the gateway node 13 (Node 2), and at a node connected to the SS7 network 11 (Node 3). Of the layers shown, the INAP/MAP, TCAP, SCCP, TCP/UDP, IP, physical layer, and MTP are substantially conventional in structure and therefore will not be described in detail. Rather, the reader should make reference to the literature including "Understanding Telecommunications", vols. 1 & 2, Studentlitteratur, Lund, Sweden (ISBN 91-44-00214-9), and the ITU-T (International Telecommunications Union - Technical) recommendations starting with Q.700 which define Signalling System Number 7 (SS7). The present discussion is concerned in the main with the Adaptation layer which enables the TCP/IP and physical layers to replace the MTP, such that peer SCCPs can communicate over the IP network 12.

As has already been discussed above, MSUs are routed to a signalling point in an SS7 network using Destination Point Codes (DPCs) which are attached to each of the MSUs. Within a signalling point, messages are directed to a specific application (e.g. HLR, VLR, etc) on the

basis of a Subsystem Number (SSN) also attached to the MSU. On the other hand, datagrams in an IP network are routed to a destination machine on the basis of an IP address, and to an application running on a particular machine on the basis of an IP port number. A main function of the Adaptation layer therefore is to translate from DPCs to IP addresses and port numbers, a process which is achieved using a database associating DPCs and IP addresses/port numbers. It is noted that translation in the reverse direction, i.e. from IP addresses/port numbers to DPCs, is not normally necessary as the MSU will in any case contain the DPC (or a global title from which the DPC can be determined).

At Node 1, for signalling data to be transmitted to Node 3, the adaptation layer determines an IP address and port number associated with the DPC/SSN contained in the message "primitive" received from the SCCP layer (this primitive is referred to as an SCCP message). The Adaptation layer then encapsulates the primitive into a format which is acceptable to the TCP (or UDP layer) before passing the information to the TCP (or UDP) layer. A further function of the Adaptation layer is to monitor the state of the connection between the two communicating peer application parts. For example, if communication between the application parts breaks down, and cannot be re-established, then the Adaptation layer may report this to the SCCP. It will be appreciated that the Adaptation layer communicates with the SCCP in a manner identical to that of the MTP.

After processing by the TCP (or UDP) layer, the messages are passed to the IP layer, the main function of which is to handle routing of datagrams over the IP network.

The messages transmitted over the IP network 12 have the following structure:

Physical header	IP header	UDP/TCP header	SIO	SCCP header	TCAP header	INAP/MAP data
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where SIO is the Service Information Octet (which, in certain circumstances, may be omitted).

At the gateway node 13 (Node 2 in Figure 4), the Adaptation layer is interposed between the TCP-UDP/IP layers and the SCCP. The adaptation layer provides again for translation between DPCs and IP addresses/port numbers. Thus, for a signalling datagram received over the IP network 12, the Adaptation layer decapsulates the message and passes it to the SCCP for further processing.

For transmission over the SS7 network 11, the SCCP passes the primitive to the MTP which handles transmission in a known manner. Similarly, the protocol layers at the receiving node (Node 3) correspond to the conventional SS7 structure.

It will be appreciated by the skilled person that various modifications may be made to the above described embodiment without departing from the scope of the present invention. For example, the connectivity of the network nodes shown in Figure 3 may be varied, such that certain IN/PLMN specific nodes are connected to the SS7 network, whilst the MSCs and/or the GMSC may be connected to the IP network. It may also be the case that nodes are connected to both the SS7 network and the IP network, such that one network provides a back-up for the other network. It is also possible to connect all nodes to two or more SS7 networks, with these networks being connected together via an IP based networks and a number of SS7/IP gateway nodes.

In a further modification to the above embodiment, the TCAP may be omitted from the processing chain, e.g. where the user application does not require the services of the TCAP. In this case, the messages transmitted over the IP network may have the structure given below.

Physical header	IP header	UDP/TCP header	SIO	SCCP header	SCCP user data
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Claims

1. A method of transmitting signalling information in a telecommunications network between a pair of application parts, the method comprising;

generating said signalling information at a first of said application parts, including addressing information associated with the second of the application parts;

passing the signalling information to a Signalling Connection Control Part (SCCP) arranged to segment the signalling information if necessary, and to encapsulate the information in one or more SCCP messages;

passing the encapsulated signalling information from the SCCP to an adaptation layer arranged to determine an IP address and port number associated with said addressing information;

passing the signalling information and said IP address and port number to an Internet Protocol (IP) part and transmitting the signalling information over an IP network to said IP address in one or more IP datagrams;

decapsulating said signalling information at the destination associated with the IP address and at an adaptation layer identified by said port number; and

routing the decapsulated signalling information to the second user part.

2. A method according to claim 1, wherein said pair of application parts are peer Mobile Application Parts (MAPs) or Intelligent Network Application Parts (INAPs) present at respective signalling nodes of a Public Land Mobile Network (PLMN).

3. A method according to claim 1 or 2 and comprising determining the IP address and port number at the

adaptation layer from a Destination Point Code (DPC) included in said addressing information.

4. A method according to claim 1 or 2 and comprising obtaining the IP address and port number at the adaptation layer directly from a global title included in said addressing information.

5. A method according to any one of the preceding claims and comprising monitoring at the adaptation layer the state of the signalling connection over the IP based network and reporting on this to the SCCP.

6. A method according to any one of the preceding claims and comprising encapsulating at the adaptation layer the signalling and addressing information into a form suitable for further processing by a UDP/TCP layer disposed between the adaptation layer and the IP part.

7. Apparatus for transmitting signalling information in a telecommunications network between a pair of application parts, the apparatus comprising;

generating means for generating said signalling information at a first of said application parts, including addressing information associated with the second of the application parts;

a Signalling Connection Control Part (SCCP) arranged to receive said signalling information and to segment the signalling information if necessary, and to encapsulate the information in one or more SCCP messages;

an adaptation layer arranged to receive the encapsulated signalling information and to determine an IP address and port number associated with said addressing information;

an Internet Protocol (IP) part receiving the signalling information and said IP address and port

number and for arranging transmission of the signalling information over an IP network to said destination IP address in one or more IP datagrams;

an adaptation layer at the destination associated with the IP address, and identified by said port number, for decapsulating said signalling information; and

routing means for routing the signalling information to the second user part.

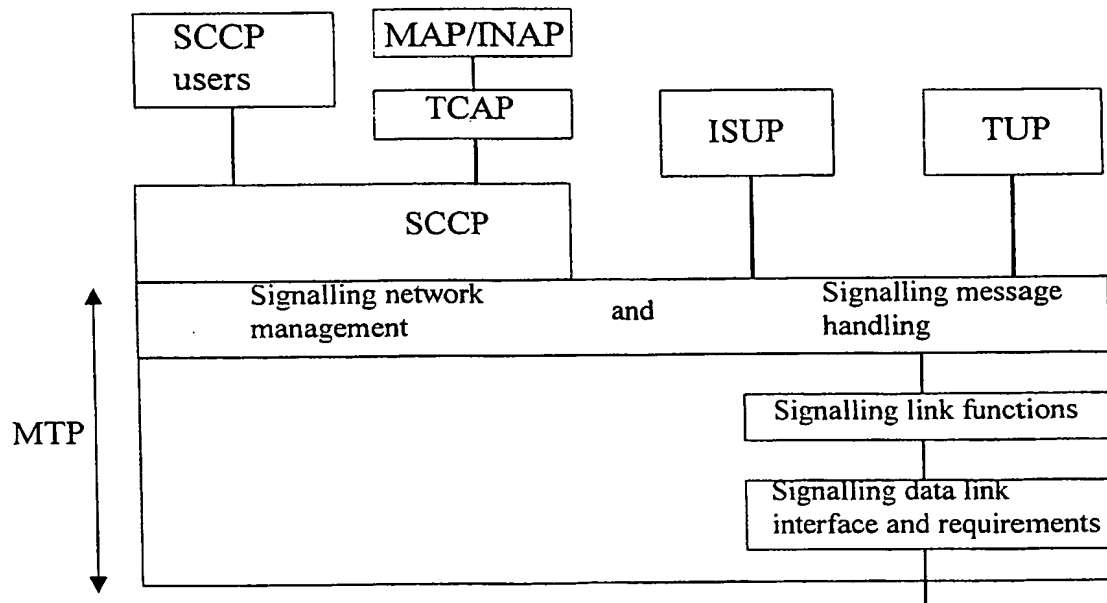
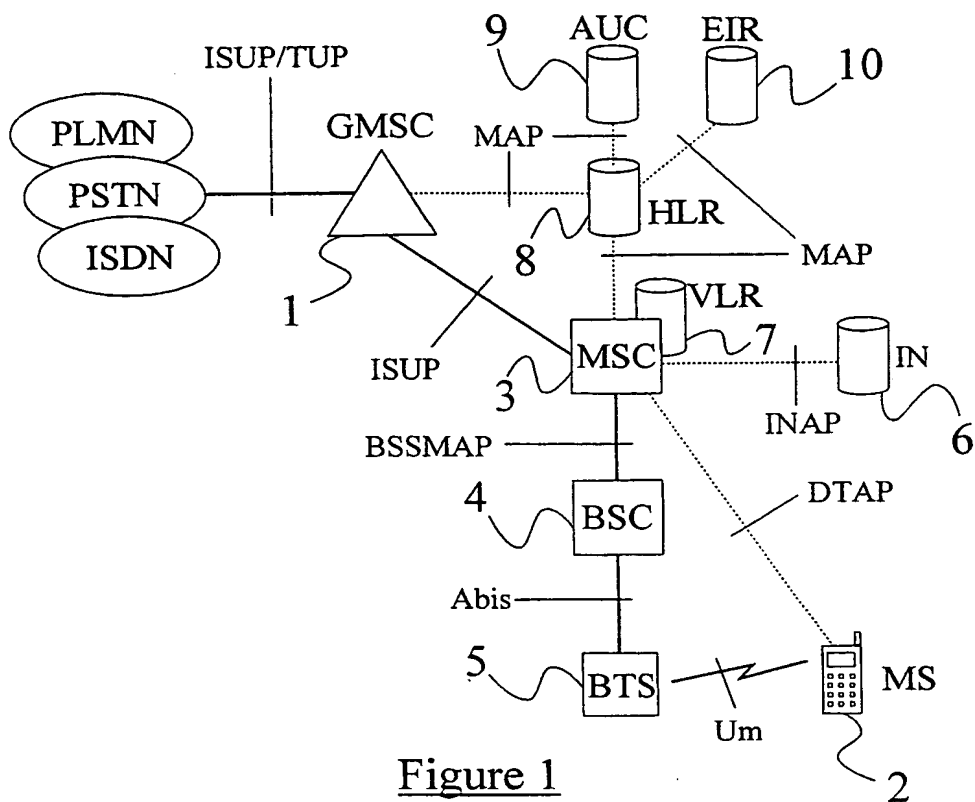
8. A gateway node for coupling signalling information from a common channel signalling (CCS) network of a telecommunications system, to an Internet Protocol (IP) based network, the gateway node comprising:

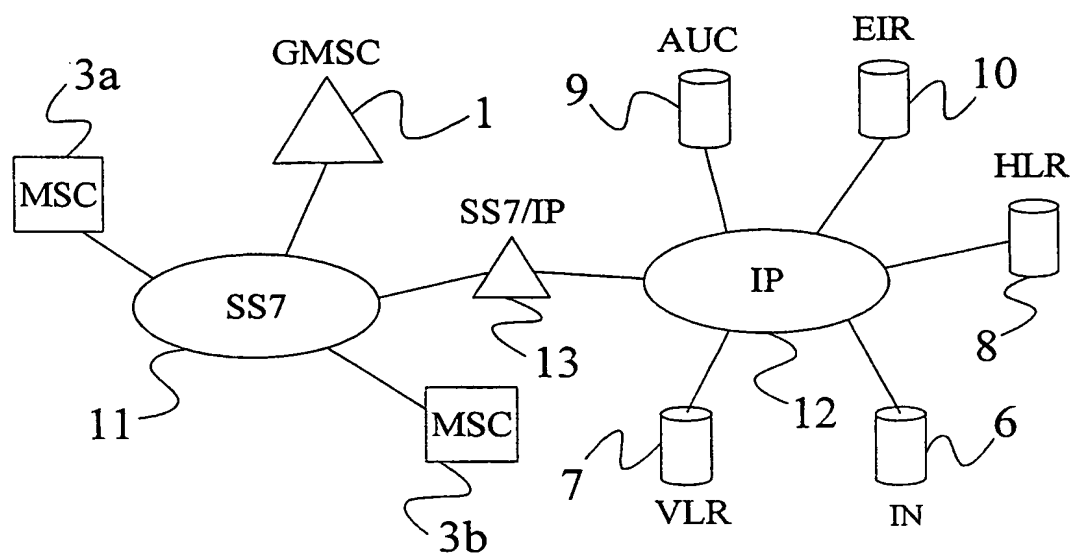
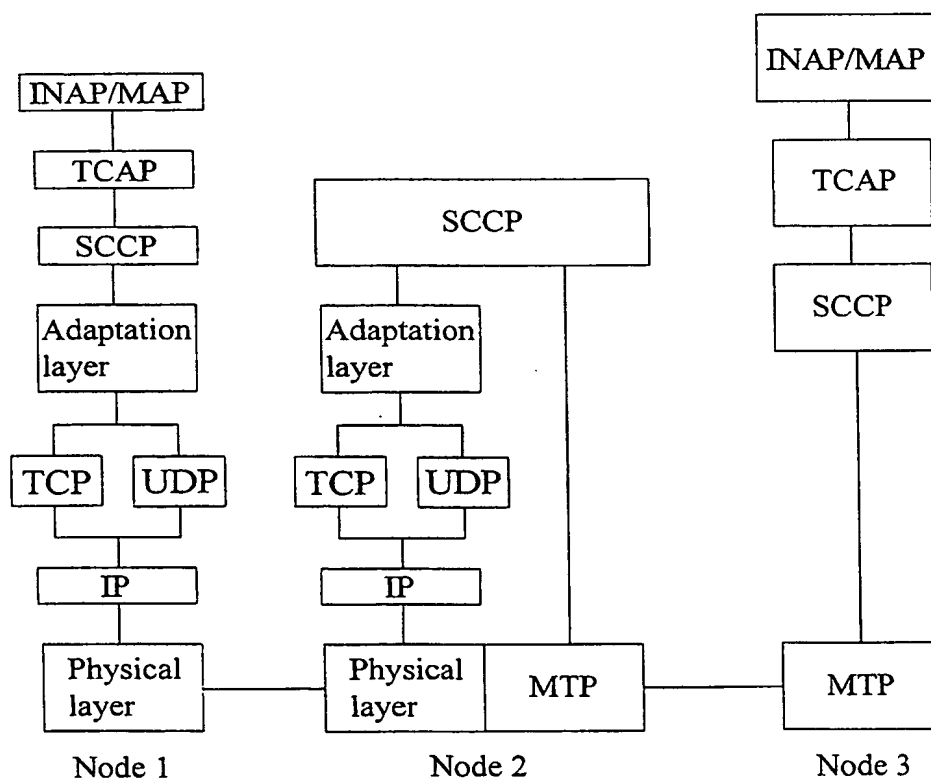
a Message Transfer Part (MTP) arranged to receive signalling information over the CCS network;

a Signalling Connection Control Part (SCCP) arranged to receive said signalling information from the MTP whilst controlling the signalling connection over the CCS network;

an adaptation layer arranged to receive said signalling information from the SCCP in the form of one or more SCCP messages, to determine an IP address and port number associated with a global title or Destination Port Code (DPC) included in the SCCP message(s), and to control the connection over the IP network;

an IP layer for receiving the signalling information and the IP address and port number from the adaptation layer and for arranging for transmission of the signalling information over the IP based network in the form of IP datagrams.



Figure 3Figure 4

INTERNATIONAL SEARCH REPORT

International Application No.

EP 99/07067

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04Q3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SEVCIK M ET AL: "CUSTOMERS IN DRIVER'S SEAT: PRIVATE INTELLIGENT NETWORK CONTROL POINT" PROCEEDINGS OF THE INTERNATIONAL SWITCHING SYMPOSIUM, DE, BERLIN, VDE VERLAG, vol. SYMP. 15, page 41-44 XP000495622 ISBN: 3-8007-2093-0 page 42, left-hand column, line 37 -right-hand column, line 51 figure 2	1,2,7,8
Y		3,4
X	US 5 793 771 A (DARLAND ET AL.) 11 August 1998 (1998-08-11) abstract column 2, line 21 -column 3, line 63 column 5, line 40 -column 6, line 7 -/-	1,5-8

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
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- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "A" document member of the same patent family

Date of the actual completion of the international search

13 January 2000

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International Application No
/EP 99/07067

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 97 42774 A (TELEFONAKTIEBOLAGET LM ERICSSON) 13 November 1997 (1997-11-13) abstract page 4, line 8 -page 6, line 16 figure 4	1,6-8
Y	US 5 706 286 A (REIMAN ET AL.) 6 January 1998 (1998-01-06) abstract column 10, line 42 -column 11, line 13	3,4

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

EP 99/07067

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			EP	0917786 A	26-05-1999
			WO	9750217 A	31-12-1997
WO 9742774	A	13-11-1997	US	5870565 A	09-02-1999
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US 5706286	A	06-01-1998	US	5966431 A	12-10-1999